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Solution by G. B. M. ZERR, A. M., Ph. D., Parsons, W. Va.

Let $x=y+z$. Then the equation becomes

$$y^7+z^7+(7yz+p)[y^5+z^5+(3yz+\tfrac{2}{7}p)(y^3+z^3)$$
$$+(5y^2z^2+\tfrac{5}{7}pyz+\tfrac{1}{49}p^2)(y+z)]+r=0.$$

Now x may be decomposed into two parts, y and z, in an infinite number of ways; we may, therefore, suppose y and z are such as to satisfy the condition $7yz+p=0$.

$\therefore\ yz=-\frac{1}{7}p,\ y^7+z^7=-r.$

Let $y^7=a,\ z^7=b.\quad \therefore\ a+b=-r,\ ab=-(\frac{1}{7}p)^7.$

$\therefore$ a and b are the roots of the equation $u^2+ru-(\frac{1}{7}p)^7=0$.

$\therefore\ a=-\frac{1}{2}r+\sqrt{[\frac{1}{4}r^2+(\frac{1}{7}p)^7]},\ b=-\frac{1}{2}r-\sqrt{[\frac{1}{4}r^2+(\frac{1}{7}p)^7]}.$

Let ω be an imaginary seventh root of unity, so that

$$\omega=\tfrac{1}{2}[A\pm\sqrt{(A^2-4)}],\ A=\tfrac{1}{3}\sqrt[3]{\tfrac{7}{2}}[\sqrt[3]{(1+3\sqrt{-3})}+\sqrt[3]{(1-3\sqrt{-3})}-\sqrt[3]{\tfrac{2}{7}}].$$

Then the required seven roots of the equation are

$$\sqrt[7]{a}+\sqrt[7]{b},\quad \omega\sqrt[7]{a}+\omega^6\sqrt[7]{b},\quad \omega^2\sqrt[7]{a}+\omega^5\sqrt[7]{b},\quad \omega^3\sqrt[7]{a}+\omega^4\sqrt[7]{b},$$
$$\omega^6\sqrt[7]{a}+\omega\sqrt[7]{b},\quad \omega^5\sqrt[7]{a}+\omega^2\sqrt[7]{b},\quad \omega^4\sqrt[7]{a}+\omega^3\sqrt[7]{b}.$$

188. **Proposed by GUY SCHUYLER.**

$xy+ab=2ax,\quad x^2y^2+a^2b^2=2b^2y^2.$

Solution by O. W. ANTHONY, Head of Mathematical Department, DeWitt Clinton High School, New York City.

By squaring the first equation and subtracting from the second we get $y=xa/b$ and $y=-2xa/b$. Whence easily $x=b,\ \frac{1}{2}(-1\pm\sqrt{3})b.\quad y=a(1\mp\sqrt{3})b/a.$

Also solved by G. W. Greenwood, B. A., Professor of Mathematics and Astronomy, McKendree College, Lebanon, Ill.; G. W. Drake, Fayetteville, Ark.; Charles E. Barrett, Louisville, Ky.; H. F. MacNeish, A. B., Instructor in Mathematics in the University High School, Chicago, Ill.; L. E. Newcomb, Los Gatos, Cal.; G. B. M. Zerr, A. M., Ph. D., Parsons, W. Va., and J. Scheffer, Kee Mar College, Hagerstown, Md.

GEOMETRY.

Problem 203 was also solved by Henry A. Converse, Ph. D., Instructor in Mathematics, Johns Hopkins University, Baltimore, Md.

208. **Proposed by W. J. GREENSTREET, A. M., Editor of The Mathematical Gazette, Stroud, England.**

Tangents drawn to two confocal parabolae from the point on the common tangent intersect at the same angle as the axes of the parabolae.

I. **Solution by G. W. GREENWOOD, A. M. (Oxon), Professor of Mathematics and Astronomy in McKendree College, Lebanon, Ill.**

PQ is the common tangent; S, the common focus. Draw PA, PA' parallel to the axes; PT, PT' are the other tangents from P; T, T' being the points of tangency. Join PS.